

REDESCRIPTION AND LECTOTYPE DESIGNATION OF *TABANUS  
SULCIFRONS* MACQUART (DIPTERA: TABANIDAE), AND  
COMPARISON TO RELATED TAXA<sup>1</sup>

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*Abstract.*—A lectotype for *Tabanus sulcifrons* Macquart is designated from four syntype females in the British Museum. Lectotypes are designated for *Tabanus tectus* Osten Sacken and *T. exul* Osten Sacken in the Museum of Comparative Zoology. *Tabanus sulcifrons* is compared to related taxa, including the late season "Carolina" form, *T. abdominalis* Fabricius, *T. gladiator* Stone, and *T. nefarius* Hine. Synonymy of *T. tectus* and *T. exul* with *sulcifrons* is confirmed.

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*Tabanus sulcifrons* was originally described by Macquart (1855) from a series of females from Baltimore, Maryland and in the Bigot collection. He did not designate a single specimen as the type, and there is now a series of four females in the British Museum (Natural History) with identical labels: "Baltimore, ex coll. J. Bigot; ex coll. G.H. Verrall, B.M. 1914-500." Also affixed to the pin bearing each specimen is a spherical yellow and white "co-type" label with "Tab. sulcifrons Mcq" on the reverse.

In the original publication (Macquart, 1855), the species is spelled *fulcifrons* (p. 33) and also is so listed in the index (p. 155). Osten Sacken (1858), in his first catalog to North American Diptera, used the original spelling, but later (Osten Sacken, 1876) spelled it *sulcifrons* and stated that Macquart's original spelling was "evidently a misprint." Osten Sacken (1878), in his North American Diptera catalog, stated "Macquart has *fulcifrons*, which, of course, is a misprint." Since Osten Sacken examined Macquart's types of exotic Tabanidae in Bigot's collection in 1873, his emendation of *fulcifrons* probably is based on examination of Macquart's original handwritten label that reads: "sulcifrons ♀ Macq. n. sp. Baltimore." This label is now folded beneath the British Museum's printed label on a now headless

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paralectotype in the British Museum (Natural History). Since Macquart's original label has *sulcifrons*, this is the spelling apparently intended by Macquart, and the one that has been in use for more than 100 years. Therefore, *sulcifrons* is retained as the correct spelling. Bigot's entire collection of exotic Tabanidae was given to the British Museum (Natural History) (Ackland and Taylor, 1972), and the series of four females of *sulcifrons* probably represents the entire type-series.

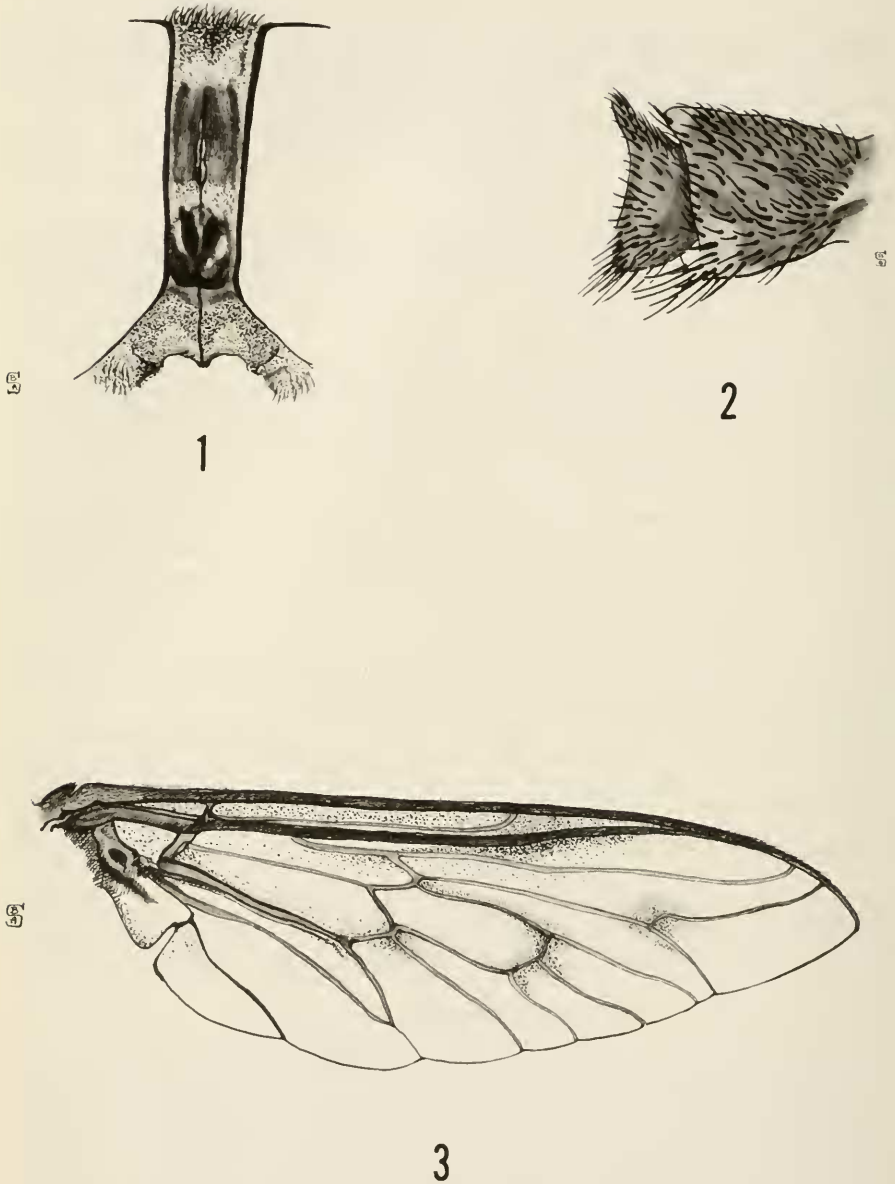
During the past 40 years, there has been much speculation about the relationship between Macquart's *sulcifrons* and certain variant populations in different parts of North America usually identified as *sulcifrons* but not identical with Macquart's original description. There is also some question about the limits of variation in *sulcifrons* and a related species, *Tabanus abdominalis* Fabricius. Recently, G. B. Fairchild (personal communication) found some specimens of *Tabanus gladiator* Stone that resemble variants of *sulcifrons*. *Tabanus sulcifrons* is also possibly related to *Tabanus nefarius* Hine.

As part of a detailed study of *T. sulcifrons* variants and their relationship to other closely related species, I had the opportunity to study the cotypes of *sulcifrons* in the British Museum (Natural History), courtesy of G. B. White. It seemed desirable to designate a specimen as lectotype and to completely describe the lectotype, since Macquart did not include critical characters needed to separate *sulcifrons* from related species, and define geographically or temporally variant populations.

Since all specimens in the syntype series are very similar morphologically, I am designating the female in the best condition as LECTOTYPE and the other three females as paralectotypes. The lectotype female is in excellent condition, except the antennal flagella are missing. One of the paralectotypes is in only fair condition, being rubbed and having the left side of the head and thorax damaged and the proboscis and palpi missing. The other two females are in good condition except one has the head missing and the other lacks parts of the meso and metathoracic legs and the antennal flagella.

#### *Tabanus sulcifrons* Macquart

Lectotype Female. Length: 20 mm; wing length: 16.8 mm. Frontal index 4.4; index of divergence 1.25; frons (Fig. 1) yellowish gray tomentose, sparsely black pilose from vertex to median callus extension, densely black pilose surrounding extension, intermixed yellowish and black pilosity above extension; callosity yellow brown, inverted U-shaped, narrowly separated from eye margins, narrowly joined to concolorous spindle-shaped median extension. Subcallus gray-brown tomentose with some yellowish tinges just above antennal bases; upper cheeks slightly brownish tinged, lower cheek and frontoclypeus gray tomentose and white pilose except for tuft of black hairs ventrolaterad of antennal bases; beard densely white pilose. Antennal



Figs. 1-3. Lectotype female of *Tabanus sulcifrons*. 1, Frons. 2, Antennal scape and pedicel (flagellum missing). 3, Wing.

scape (Fig. 2) orange overlain with gray tomentosity and black setose; flagella missing; 2nd segment of palpus (Fig. 4) yellow-brown tomentose, black setose, moderately stout basally, evenly tapered and broadly rounded apically, not acutely pointed,  $4\times$  longer than greatest width.

Mesonotum yellowish to gray-brown tomentose, overlain with a thin grayish tomentose pattern consisting of a narrow, distinct median gray stripe and 2 pairs of sublateral diffuse grayish stripes, black and yellowish pilosity intermixed; antealar tubercle orange, black pilose; prescutellar sclerite densely black pilose; wing base and postalarare densely pale pilose; scutellum gray tomentose, black pilose on disc, pale pilose on posterior and lateral margins of disc. Pleura dark grayish to yellowish-gray tomentose and yellowish-white pilose, except black hairs intermixed on anterior margin of mesopleuron. Fore coxa gray tomentose and white pilose on basal  $\frac{2}{3}$ , becoming blackish and black pilose on apical  $\frac{1}{3}$ , mid and hind coxae yellowish gray tomentose, pale pilose; fore femur dark brown to black, dark gray tomentose on outer margin, black setose, mid and hind femora yellow-brown and grayish tomentose, inner  $\frac{1}{2}$  of mid femur black pilose on basal  $\frac{2}{3}$ , becoming pale pilose on apical  $\frac{1}{3}$ , outer  $\frac{1}{2}$  pale pilose, hind femur mixed black and pale pilose on basal  $\frac{1}{2}$ , pale pilose on apical  $\frac{1}{2}$ ; basal  $\frac{1}{2}$  of fore tibia orange and pale yellowish pilose, apical  $\frac{1}{2}$  blackish, black pilose, mid and hind tibiae orange, becoming slightly darker apically, pale yellow pilose basally, black pilose apically, hind tibial fringe black; fore tarsus blackish and black setose, mid tarsus brownish, black setose, hind tarsus black and black setose; pulvilli and empodium orange. Wing (Fig. 3) with costal cell deep yellowish tinted, basal  $\frac{1}{3}$  of wing yellowish tinted, otherwise light brown tinted with darker brown clouds on crossveins, vein  $R_4$  without appendix, 1st posterior cell of wing narrowed but open at edge of wing. Halter with stalk light yellowish, knob yellowish brown.

Abdomen yellow brown, with distinct median yellow-gray tomentose triangles on tergites 2-5, tergites 2-4 with a small black-pigmented spot just anterior to apex of pale triangles, tergites 2-6 narrowly yellowish gray tomentose on posterior margins, tergites 1-2 yellow pilose with some black pilosity intermixed, especially submedianly and around median triangles, tergites 4-7 becoming predominantly brownish to black and black pilose, tergites 2-5 with pale yellow pilose hind margins; venter yellow orange with narrow grayish posterior margins on sternites 2-7, predominantly yellow pilose on sternites 1-5, black pilose on sternites 6-7, sternite 7 bearing erect black setae and pale pilose fringe on posterior margin.

The 3 paralectotype females are nearly identical to the lectotype. Length varies from 18.4-21.6 mm and the frontal index varies from 4.2-4.4.

*Discussion.*—*Tabanus sulcifrons* was originally described as *Tabanus variegatus* by Fabricius (1805), from "North America," but this name was preoccupied by a Neotropical species, *Tabanus variegatus* DeGeer (=Chry-

*sops variegatus* (DeGeer)). Wiedemann (1828) provided a more complete description of Fabricius' *variegatus* using Fabricius' specimens from Georgia, U.S.A. Based on his description, it seems likely that these represent the late season southern variant of *sulcifrons*. The lilac-reddish thorax, white lateral abdominal incisures, and wings of a whitish color ("Wirklich von Weisslicher Farbe") agree with the now recognized late season form.

Osten Sacken (1876) described *Tabanus tectus* from a series of six females and two males from Doubling Gap, Pennsylvania. He compared these specimens with those of *Tabanus abdominalis*, but not *sulcifrons*. Subsequently, he synonymized *tectus* with *sulcifrons*, after examining the types of *sulcifrons* in the Bigot Collection. Examination of the *tectus* cotypes, courtesy of the Museum of Comparative Zoology (MCZ), Harvard University, confirms that *tectus* is identical to Macquart's *sulcifrons*. A female in the MCZ collection is herewith designated as LECTOTYPE of *tectus*, with remaining females designated paralectotypes.

Osten Sacken (1878) described *Tabanus exul* from a series of 20 females and three males from various localities in the District of Columbia, Maryland, Pennsylvania, and New Jersey. Comparison of *T. exul* cotypes in the MCZ with the syntype series of *sulcifrons* revealed that they are identical, except that two males appear to be the late season form discussed below and not identical with Marquart's syntypes. A female in the MCZ collection from the type-series is herewith designated the LECTOTYPE of *exul*. The other females of the type-series are designated paralectotypes, including one female now in the collection of the California Academy of Sciences.

*Tabanus sulcifrons* exhibits considerable morphological variation throughout its extensive range in North America, from Florida north to southern Canada, west to Oklahoma and Texas. At present, these "forms" are lumped under *sulcifrons*. Stone (1938) found that variants did not appear to sort out geographically and exhibited extensive intergradation that defied separation. In southern Texas, some specimens are extremely dark, the body being dark brown to blackish. In New York, there appear to be two distinct populations, a rather small, uncommon eastern form that is geographically isolated from the larger "typical" specimens in the western part of the state. Pechuman (1972) stated that the population in western New York appeared about 30 years ago and currently is moving eastward, but has not yet joined the eastern New York population.

The best defined variant of *sulcifrons* is what L. L. Pechuman (personal communication) has called the "Carolina form." This form is most common in the southeastern United States from Maryland south to Florida and tends to fly later than the early season form where distribution overlaps. Based on limited data from Tennessee in 1977 (B. Mullens, personal communication), the early season form was collected from 23 June to 27 July; the Carolina form from 18 August to 20 September. In eastern Maryland my



Fig. 4. Lectotype female of *Tabanus sulcifrons*, maxillary palpus.

extensive collections of *T. sulcifrons* in 1972–1974 showed that the early season form occurred from early July to early August; the Carolina form occurred from mid-August to late September. Thus, in both areas the early form seems to be temporally isolated from the Carolina form.

Comparison of the Carolina form with Macquart's syntype series revealed numerous differences as follows: Antennal scape and pedicel blackish; second segment of palpus grayish black, elongate and more slender basally, nearly as slender as the palpi of *T. gladiator*; mesonotum predominantly gray to gray-brown tomentose, pattern of lines similar to *sulcifrons* but less well-defined, pale pilosity silvery to yellowish, pilosity around margins of mesonotum and scutellum white; pleura dark gray tomentose, with large spot of black pilosity on mesopleuron, otherwise densely white pilose; fore femur black, black pilose, mid and hind femora blackish, gray tomentose, black pilose dorsally on basal half, otherwise white pilose; mid and hind tibiae pale brownish on basal  $\frac{1}{3}$  to  $\frac{1}{2}$ , blackish apically; tarsi black, wing with costal cell yellow-brown, membrane light brown-tinted, with darker clouds on crossveins, 1st posterior cell not strongly narrowed, always open to posterior wing margin, wing surface, especially within cells pale frosted, contrasting sharply with brown tinting; abdomen orange to reddish orange, tergite 1 with a spot of pale pilosity beneath scutellum, tergites 1–4 orange, black pilose, posterior tergites becoming blackish, tergites 2–6 with pale median triangles variably developed and with pale whitish marginal incisures present laterally but absent medianly; venter yellow-brown tomentose, pale yellowish-white pilose, sternite 7 grayish tomentose.

Most specimens of the Carolina form can be separated from early season *sulcifrons* without difficulty, but some specimens are sufficiently variable that separation cannot always be unequivocal. This variation includes both physical and tinctorial characters. Temporal isolation of early and late sea-

son forms in some localities suggests that these forms may be specifically distinct, but this determination awaits detailed analysis, now in progress, of character variation, temporal and geographic variation.

*Tabanus sulcifrons* from other localities throughout its known geographic range shows bewildering patterns of variation. Characters such as the frontal index, palpus, color and shape, color of the legs, thorax and abdomen, and shape of the 1st posterior cell of the wing previously used to define the species and separate it from related taxa are too variable and imprecisely defined at present to be useful, even in limited geographic areas. The result has been to recognize a single highly variable species. Stone (1938) has emphasized the status of *sulfifrons* as a variable species.

*Tabanus abdominalis* Fabricius, a species closely related to *T. sulcifrons*, has been separated from it by the narrower frons, black femora, dark mesonotum with distinct pale thoracic lines, closed 1st posterior cell and the distinct black spots, and lack of mid-dorsal triangles on the abdomen.

Undoubted *T. abdominalis* specimens were compared with the syntype series of *sulfifrons* and differed as follows: frontal index 5.0–6.1 (4.2–4.4 in *sulfifrons*), therefore frons distinctly narrower; palpus black and black setose, more abruptly tapered to acute point; mesonotum gray-black tomentose, with pale lines gray tomentose and white pilose, antalar tubercles blackish; coxae black pilose on inner margin, white pilose on outer margin, femora black and black pilose, except a tuft of pale hairs dorsally at base; 1st posterior cell of wing usually closed and petiolate or very narrowly open to posterior margin; abdomen yellow brown to orange with broad orange incisures on posterior margins of tergites 2–6 and golden pilose, tergites 2–4 wholly black basally or with black median spots crossing tergites 5–7; venter orange, golden pilose except blackish and black setose on sternite 7.

Although most specimens of *abdominalis* can be separated from *sulfifrons*, some specimens have a broader frons, paler palpus, and tinctorial variation on the legs, thorax, and abdomen. Occasionally some *abdominalis* and darker *sulfifrons* are difficult to separate with certainty, particularly if the pale abdominal triangles are poorly developed. Study of the entire range of variation in *sulfifrons* will be necessary to determine what characters intergrade with those now used to define *abdominalis*.

*Tabanus gladiator* Stone usually is easily distinguished from *T. sulcifrons* by the narrow frons (index about 6.0), narrow, strap-like palpus, reddish-brown mesonotum overlain with gray tomentum, giving the mesonotum a lavender tone, black legs (except basal half of fore tibiae and pale bases of mid and hind tibiae in most specimens), and the uniformly orange-brown, black pilose abdomen lacking pale median triangles. Fairchild (personal communication) has collected specimens in Florida that have extensive orange pilosity and pale median triangles on the abdomen, characteristic of *sulfifrons*. Since the Carolina form of *sulfifrons* usually has narrower pal-

pus and predominantly black pilose abdomen and is a late season flier as is *gladiator*, there is some question about the intergradation of *gladiator* and the Carolina form of *sulcifrons*, at least in some Florida localities. I have seen no "sulcifrons-like" *gladiator* in my extensive collections from Maryland, where both species are active at the same time.

*Tabanus nefarius* Hine is an uncommon species that may be related to *sulcifrons*. It has been separated from *sulcifrons* by the uniformly orange-brown legs (including fore tibiae), narrower frons, and brown abdomen. A study of the limits of *sulcifrons* variation should include examination of *T. nefarius*.

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